

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions of claims in the application.

LISTING OF THE CLAIMS:

Claim 1 (Currently Amended): A method for determining a regular N-polygonal figure for a boring hole having vertexes of N in number, characterized in that:

the center point (S) of a regular N-polygonal figure to be determined is set as a fixed point;

a point, which is distant by a certain length from the said center point (S) and revolves around the center point (S), is set as a first point (E);

a point, which is distant by a certain length from the first point (E) and revolves around the first point (E), is set as a second point (M); and

assuming that the second point (M) revolves around the first point (E) at an angular velocity ω , that the first point (E) revolves around the center point (S) at an angular velocity $(1-N)\omega$, that the first point (E) is away from the center point (S) by a distance (r), and that the second point (M) is away from the first point (E) by a distance $(N-1)^2r$, the locus of the second point (M) defines a contour of a regular N-polygonal figure to be determined being circumscribed on a circle having a radius $N(N-2)r$; and

boring a hole having a shape defined by the contour of the regular N-polygonal figure;

the contour of the regular N-polygonal figure can be defined by a function $f(\theta)$;

the function $f(\theta)$ is a one-valued function;

the function $f(\theta)$ is a periodic function with a period $2\pi/N$;

the function $f(\theta)$ has one maximum value and one minimum value in one period,

the function $f(\theta)$ has line symmetry with respect to the center of the minimum point between the two maximum points, in regard to one period from a maximum point to the next maximum point of the function $f(\theta)$; and

the function $f(\theta)$ has a positive curvature or no curvature.

Claim 2 (Currently Amended): A method for determining a regular N-polygonal figure for a boring hole having vertexes of N in number, characterized in that:

a regular (N-1)-polygonal figure revolves along a circle, which circle is concentric to the center of a regular N-polygonal figure to be determined and has a radius r, and rotates at an angular velocity ω ;

a contour of the said regular (N-1)-polygonal figure is inscribed on a circle having a radius $(N-1)^2r$;

the regular (N-1)-polygonal figure revolves at an angular velocity $(1-N)\omega$; and

an area being swept by the said regular (N-1)-polygonal figure defines a regular N-polygonal figure to be determined, which figure is circumscribed on a circle having a radius $N(N-2)r$; and

boring a hole having a shape defined by the the regular N-polygonal figure;

the contour of the regular N-polygonal figure can be defined by a function $f(\theta)$;

the function $f(\theta)$ is a one-valued function;

the function $f(\theta)$ is a periodic function with a period $2\pi/N$;

the function $f(\theta)$ has one maximum value and one minimum value in one period,

the function $f(\theta)$ has line symmetry with respect to the center of the minimum point between the two maximum points, in regard to one period from a maximum point to the next maximum point of the function $f(\theta)$; and

the function $f(\theta)$ has a positive curvature or no curvature.

Claim 3 (Currently Amended): A method for determining a regular N-polygonal figure for a boring hole having vertexes of N in number, characterized in that:

a regular (N+1)-polygonal figure revolves along a circle, which circle is concentric to the center of a regular N-polygonal figure to be determined and has a radius r, and rotates at an angular velocity ω ;

a contour of the said regular (N+1)-polygonal figure is inscribed on a circle having a radius $(N+1)^2r$;

the regular (N+1)-polygonal figure revolves at an angular velocity $(N+1)\omega$;

an area being swept by the said regular (N+1)-polygonal figure defines a regular N-polygonal figure to be determined, which figure is circumscribed on a circle having a radius $N(N+2)r$; and

boring a hole having a shape defined by the regular N-polygonal figure;

the contour of the regular N-polygonal figure can be defined by a function $f(\theta)$;

the function $f(\theta)$ is a one-valued function;

the function $f(\theta)$ is a periodic function with a period $2\pi/N$;
the function $f(\theta)$ has one maximum value and one minimum value in one period,
the function $f(\theta)$ has line symmetry with respect to the center of the minimum point
between the two maximum points, in regard to one period from a maximum point to the next
maximum point of the function $f(\theta)$; and
the function $f(\theta)$ has a positive curvature or no curvature.

Claim 4 (Currently Amended): A method for determining a figure for a regular N-
polygonal figure for a boring hole comprises steps for:

setting a fixed center point;

setting a first point which is away from the center point by a certain length and revolves
around the center point;

setting a second point which is away from the first point by a certain length and revolves
around the first point;

setting an angular velocity ω at which the second point revolves around the first point;

setting an angular velocity $(1-N)\omega$ at which the first point revolves around the center
point;

setting a distance between the first point and the center point as a distance r ;

setting a ratio of the distance between the center point and the first point to the length of a
line segment connecting the first and second points being smaller than $(N-1)^2$; and

defining a figure to be determined by the locus of the second point, which figure has vertexes of N in number, is circumscribed on a circle having a radius $N(N-2)r$, and is a single closed region formed by curves; and

boring a hole having a shape defined by the figure;

a contour of the regular N -polygonal figure can be defined by a function $f(\theta)$;

the function $f(\theta)$ is a one-valued function;

the function $f(\theta)$ is a periodic function with a period $2\pi/N$;

the function $f(\theta)$ has one maximum value and one minimum value in one period,

the function $f(\theta)$ has line symmetry with respect to the center of the minimum point between the two maximum points, in regard to one period from a maximum point to the next maximum point of the function $f(\theta)$; and

the function $f(\theta)$ has a positive curvature or no curvature.

Claim 5 (Canceled).

Claim 6 (Currently Amended): An apparatus for determining a regular N -polygonal figure for a boring hole having vertexes of N in number, characterized in that the said apparatus includes an input means and a control means,

the said input means is constructed to carry out functions for:

setting a center point of a regular N -polygonal figure to be determined as a fixed point;

setting a first point which is away from the center point by a certain length and revolves around the center point;

setting a second point which is away from the first point by a certain length and revolves around the first point;

setting an angular velocity ω at which the second point revolves around the first point;

setting an angular velocity $(1-N)\omega$ at which the first point revolves around the center point;

setting a distance r between the first point and the center point; and

setting a distance $(N-1)^2r$ between the second point and the first point; and that

the said control means is constructed so as to carry out functions for defining a regular N -polygonal figure to be determined by the locus of the second point, which figure is circumscribed on a circle having a radius $N(N-2)r$; and

boring a hole having a shape defined by the regular N -polygonal figure;

a contour of the regular N -polygonal figure can be defined by a function $f(\theta)$;

the function $f(\theta)$ is a one-valued function;

the function $f(\theta)$ is a periodic function with a period $2\pi/N$;

the function $f(\theta)$ has one maximum value and one minimum value in one period,

the function $f(\theta)$ has line symmetry with respect to the center of the minimum point between the two maximum points, in regard to one period from a maximum point to the next maximum point of the function $f(\theta)$; and

the function $f(\theta)$ has a positive curvature or no curvature.

Claim 7 (Currently Amended): An apparatus for determining a regular N-polygonal figure for a boring hole having vertexes of N in number, characterized in that the said apparatus includes an input means and a control means,

the said input means is constructed to carry out functions for:

inputting so as to revolve a regular (N-1)-polygonal figure along a circle, which circle is concentric to the center of a regular N-polygonal figure to be determined and has a radius r;

inputting so as to rotate such the regular (N-1)-polygonal figure at an angular velocity ω ;

setting the regular (N-1)-polygonal figure so as to define a contour which is inscribed on a circle having a radius $(N-1)^2 r$; and

setting an angular velocity $(1-N)\omega$ at which the regular (N-1)-polygonal figure revolves:
and that

the said control means is constructed to carry out a function for defining a regular N-polygonal figure to be determined, which is circumscribed on a circle having a radius $N(N-2)r$, by an area being swept by the regular (N-1)-polygonal figure; and

boring a hole having a shape defined by the regular N-polygonal figure;

a contour of the regular N-polygonal figure can be defined by a function $f(\theta)$;

the function $f(\theta)$ is a one-valued function;

the function $f(\theta)$ is a periodic function with a period $2\pi/N$;

the function $f(\theta)$ has one maximum value and one minimum value in one period.

the function $f(\theta)$ has line symmetry with respect to the center of the minimum point between the two maximum points, in regard to one period from a maximum point to the next maximum point of the function $f(\theta)$; and

the function $f(\theta)$ has a positive curvature or no curvature.

Claim 8 (Currently Amended): An apparatus for determining a regular N-polygonal figure for a boring hole having vertexes of N in number, characterized in that the said apparatus includes an input means and a control means,

the said input means is constructed to carry out functions for:

inputting so as to revolve a regular (N+1)-polygonal figure along a circle, which circle is concentric to the center of a regular N-polygonal figure to be determined and has a radius r;

inputting so as to rotate such the regular (N+1)-polygonal figure at an angular velocity ω ;

setting the regular (N+1)-polygonal figure so as to define a contour which is inscribed on a circle having a radius $(N+1)^2r$; and

setting an angular velocity $(N+1)\omega$ at which the regular (N+1)-polygonal figure revolves:
and that

the said control means is constructed to carry out a function for defining a regular N-polygonal figure to be determined, which is circumscribed on a circle having a radius $N(N+2)r$, by an area being swept by the regular (N+1)-polygonal figure; and

boring a hole having a shape defined by the regular N-polygonal figure;

the contour of the regular N-polygonal figure can be defined by a function $f(\theta)$;

the function $f(\theta)$ is a one-valued function;

the function $f(\theta)$ is a periodic function with a period $2\pi/N$;

the function $f(\theta)$ has one maximum value and one minimum value in one period,

the function $f(\theta)$ has line symmetry with respect to the center of the minimum point
between the two maximum points, in regard to one period from a maximum point to the next
maximum point of the function $f(\theta)$; and

the function $f(\theta)$ has a positive curvature or no curvature.

Claim 9 (Currently Amended): An apparatus for determining a figure for a boring hole, characterized in that the said apparatus includes an input means and a control means, the said input means is constructed to carry out functions for:

setting a center point as a fixed point;

setting a first point which is away from the center point by a certain length and revolves around the center point;

setting a second point which is away from the first point by a certain length and revolves around the first point;

setting an angular velocity ω at which the second point revolves around the first point;

setting an angular velocity $(1-N)\omega$ at which the first point revolves around the center point;

setting a distance r between the first point and the center point;

setting a ratio of the distance between the center point and the first point to the length of a line segment, which connects the first and second points, being smaller than $(N-1)^2$: and

the said control means is constructed to carry out a function for defining a figure to be determined by the locus of the second point, which figure has vertexes of N in number, is circumscribed on a circle having a radius $N(N-2)r$, and is a single closed region formed by curves; and

boring a hole having a shape defined by the figure;

a contour of the regular N -polygonal figure can be defined by a function $f(\theta)$;

the function $f(\theta)$ is a one-valued function;

the function $f(\theta)$ is a periodic function with a period $2\pi/N$;

the function $f(\theta)$ has one maximum value and one minimum value in one period,

the function $f(\theta)$ has line symmetry with respect to the center of the minimum point between the two maximum points, in regard to one period from a maximum point to the next maximum point of the function $f(\theta)$; and

the function $f(\theta)$ has a positive curvature or no curvature.

Claim 10 (Canceled).